Figure 1

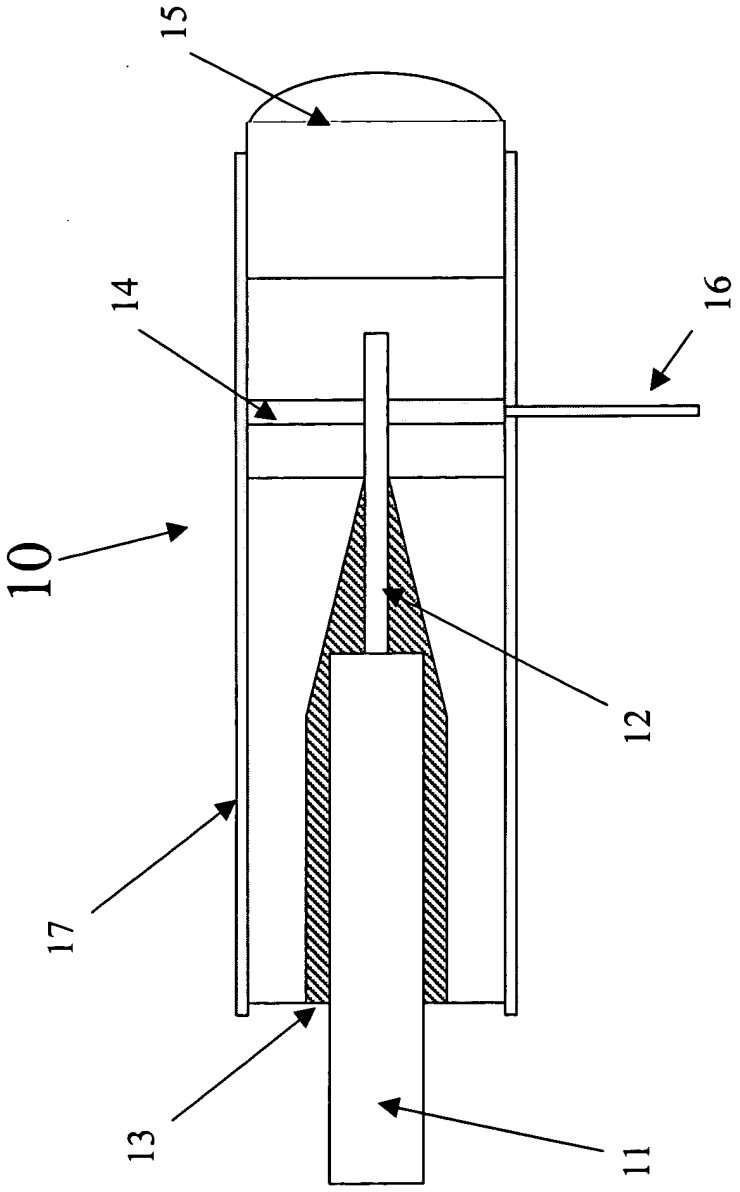


Figure 2

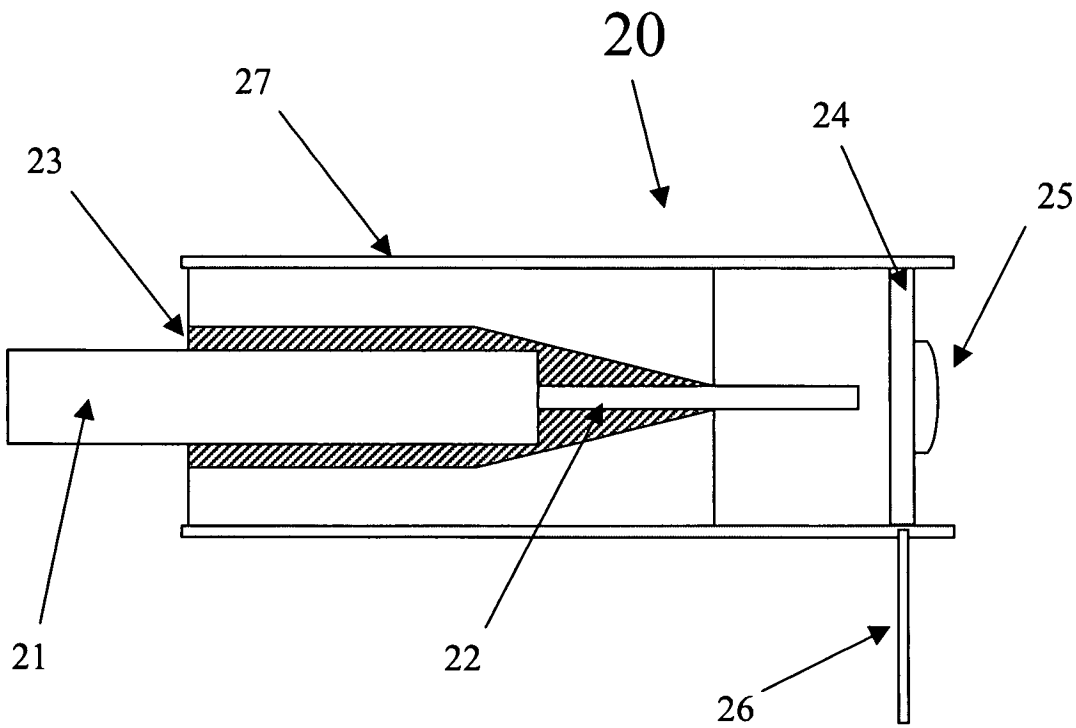
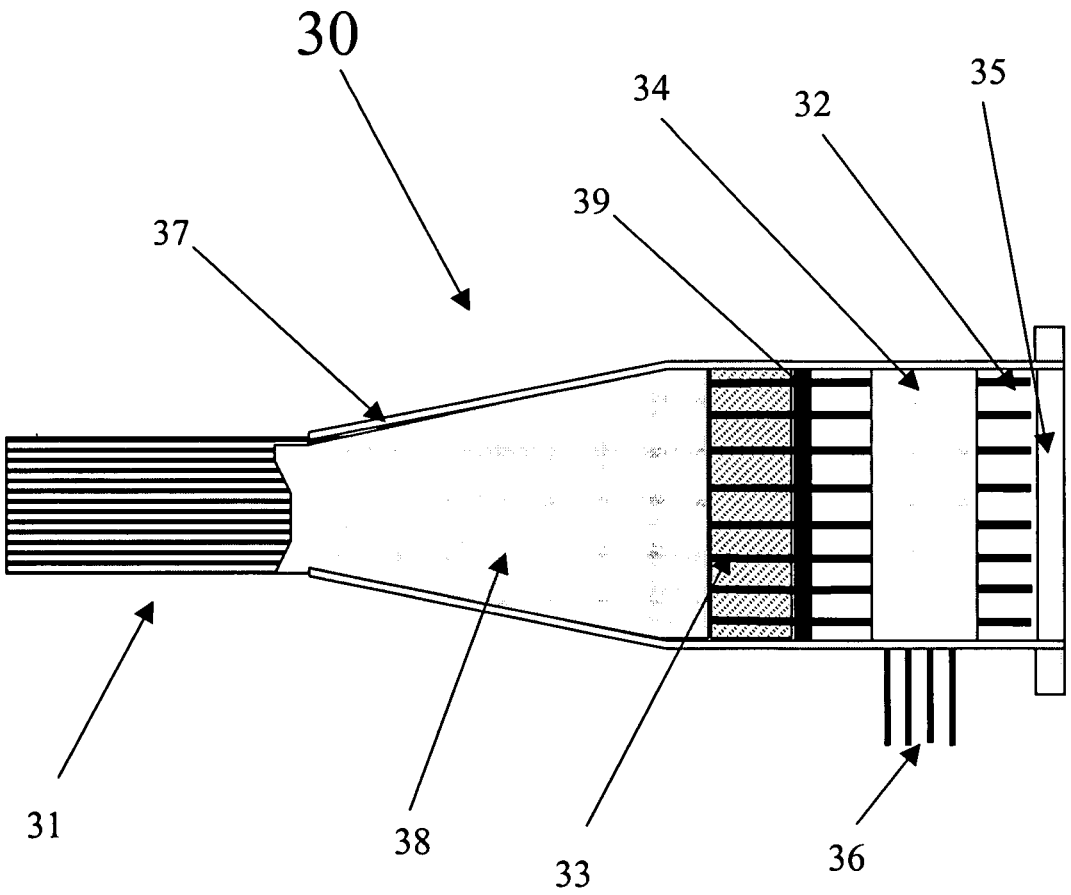
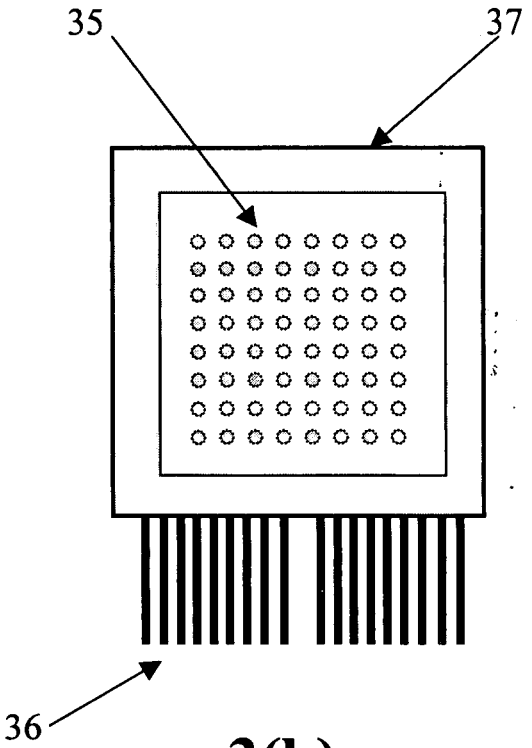


Figure 3

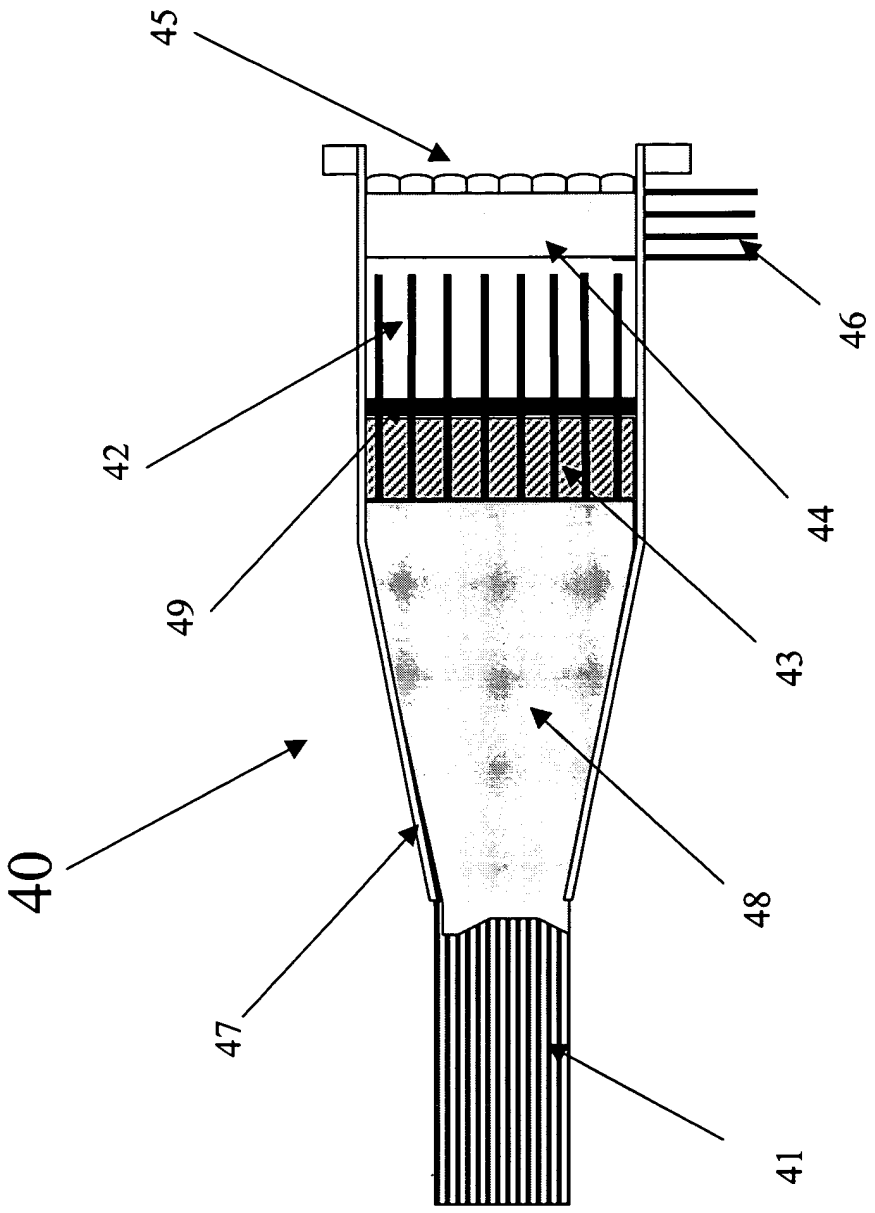


3(a)



3(b)

Figure 4



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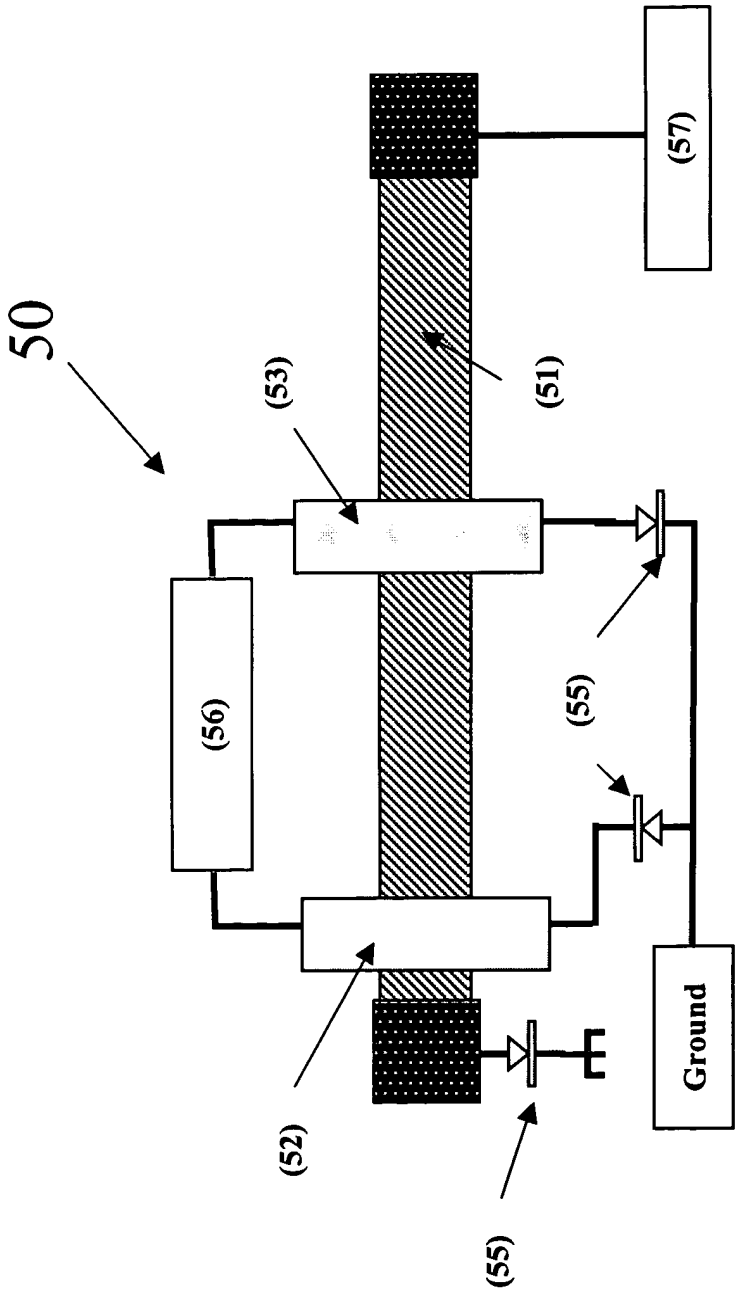

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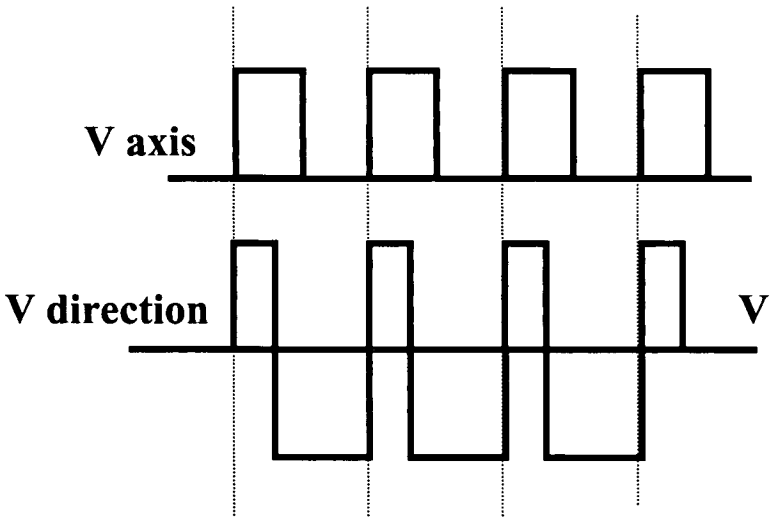
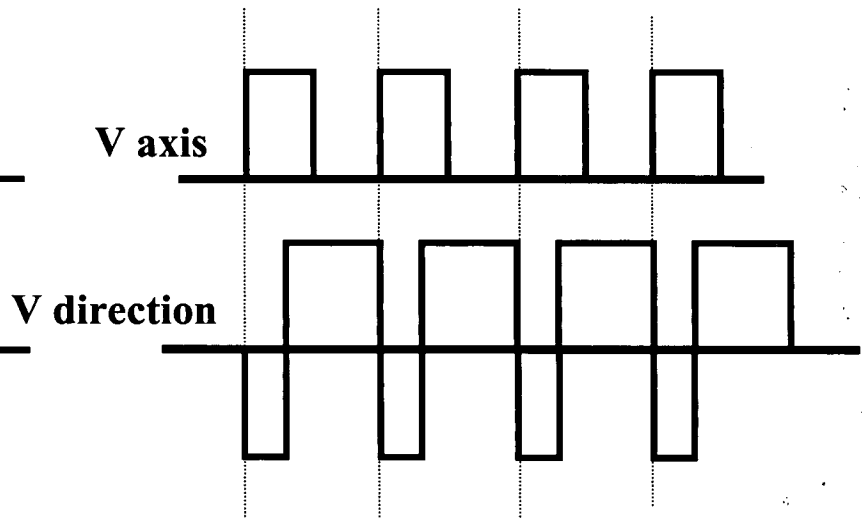


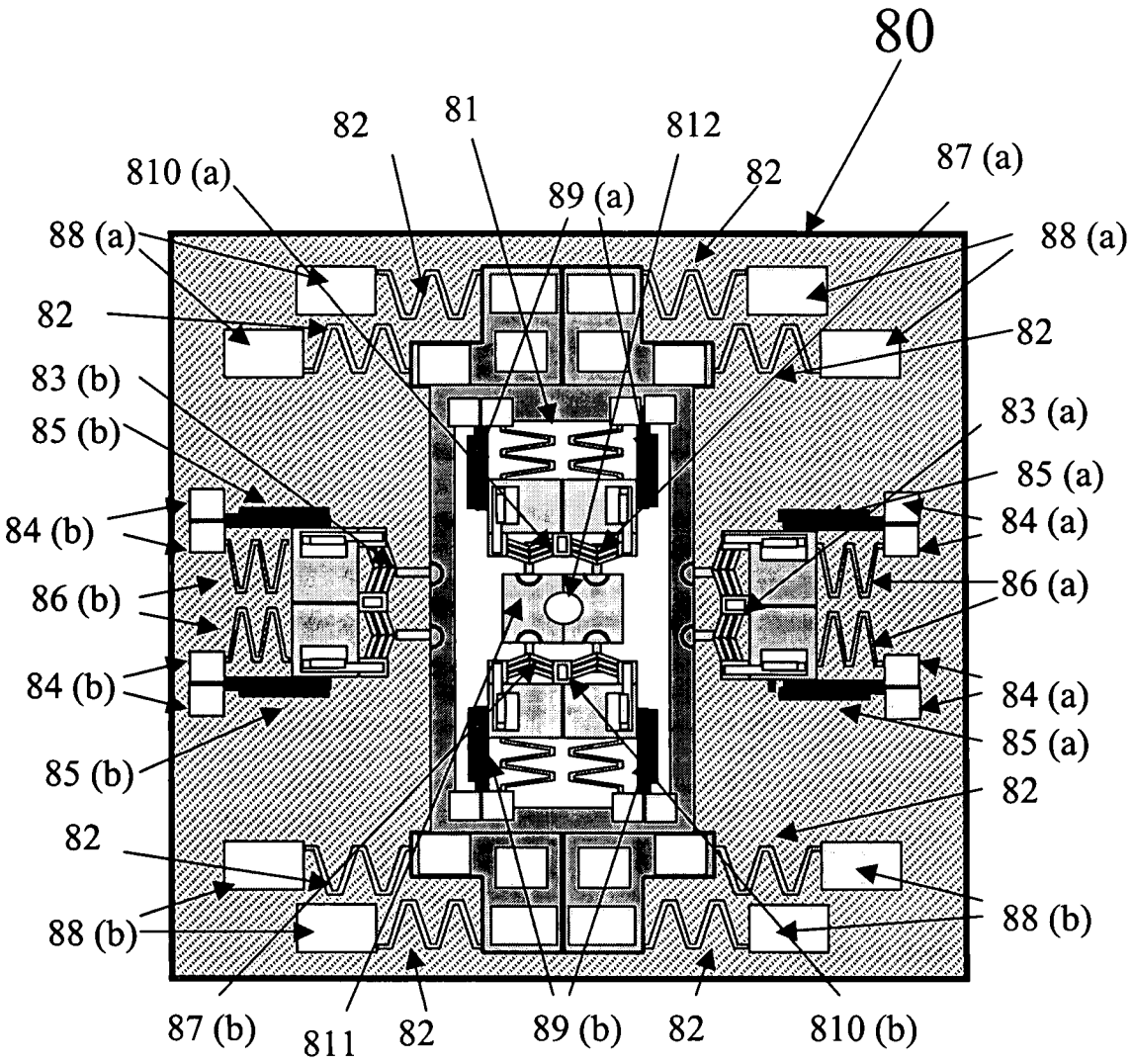
Move Right

Figure 7



Move Left

Figure 8(a)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82
81
812
810 (a)
89 (a)
82
87 (a)
88 (a)
88 (a)
82
82
83 (b)
85 (b)
83 (a)
85 (a)
84 (b)
84 (a)
86 (b)
86 (a)
84 (b)
84 (a)
85 (a)
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82
82
88 (b)
88 (b)
87 (b)
811
82
89 (b)
82
810 (b)

Figure 8(b)

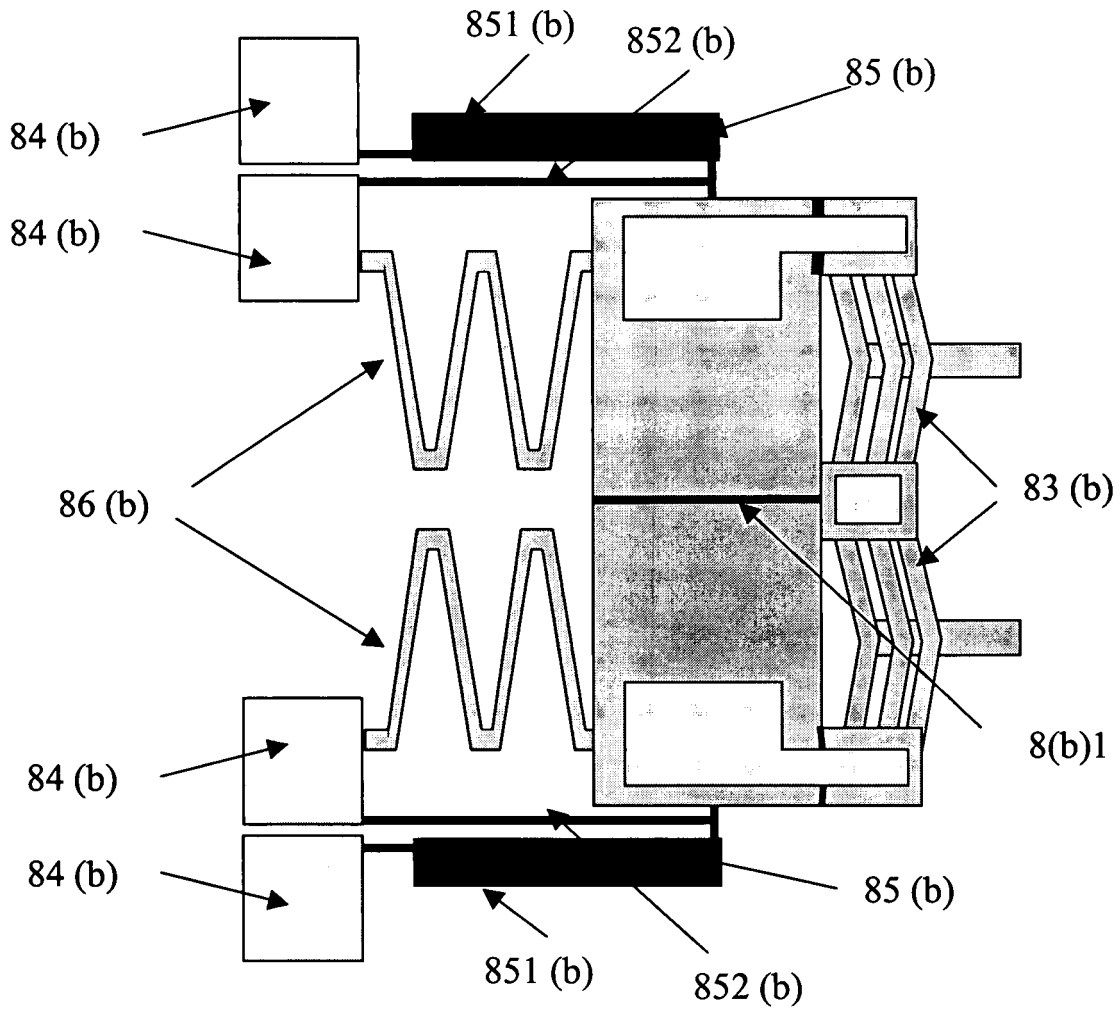


Figure 9

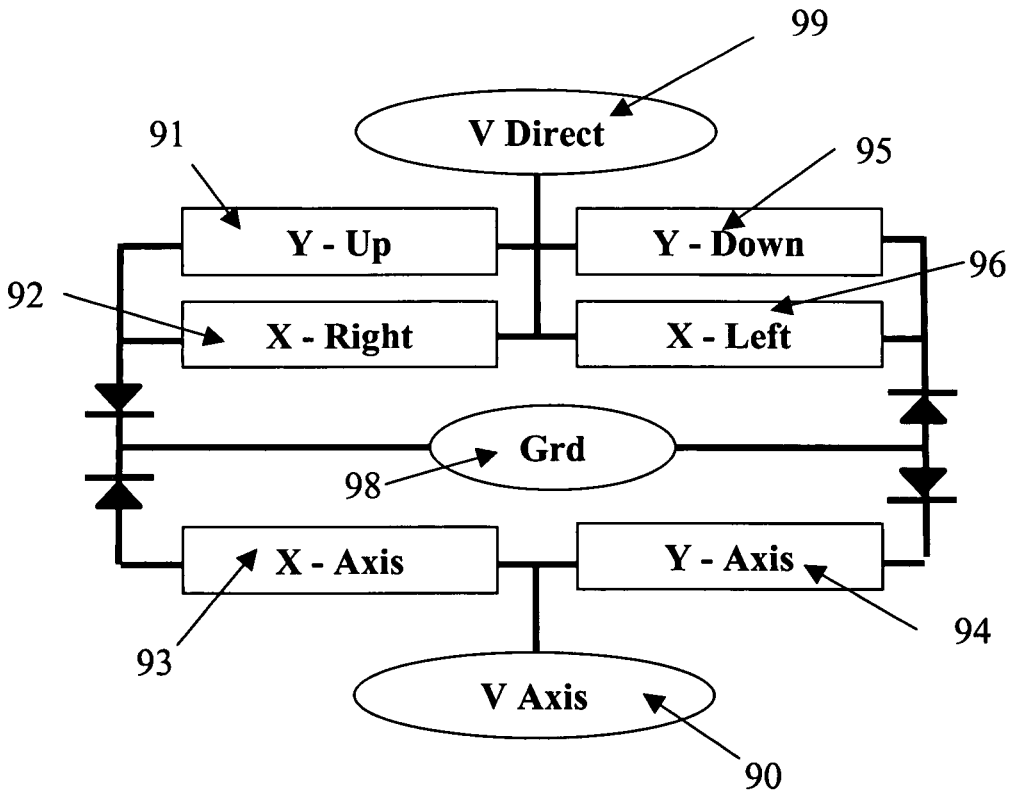

99
V Direct
91
95
Y - Up
Y - Down
96
92
X - Right
X - Left
Grd
98
X - Axis
Y - Axis
94
93
V Axis
90

Figure 10

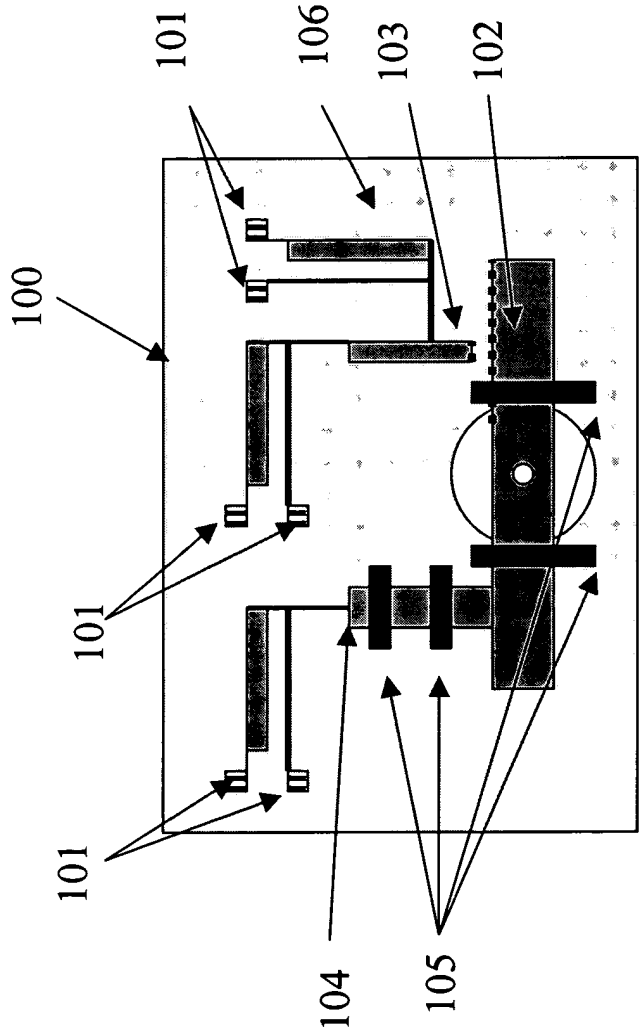
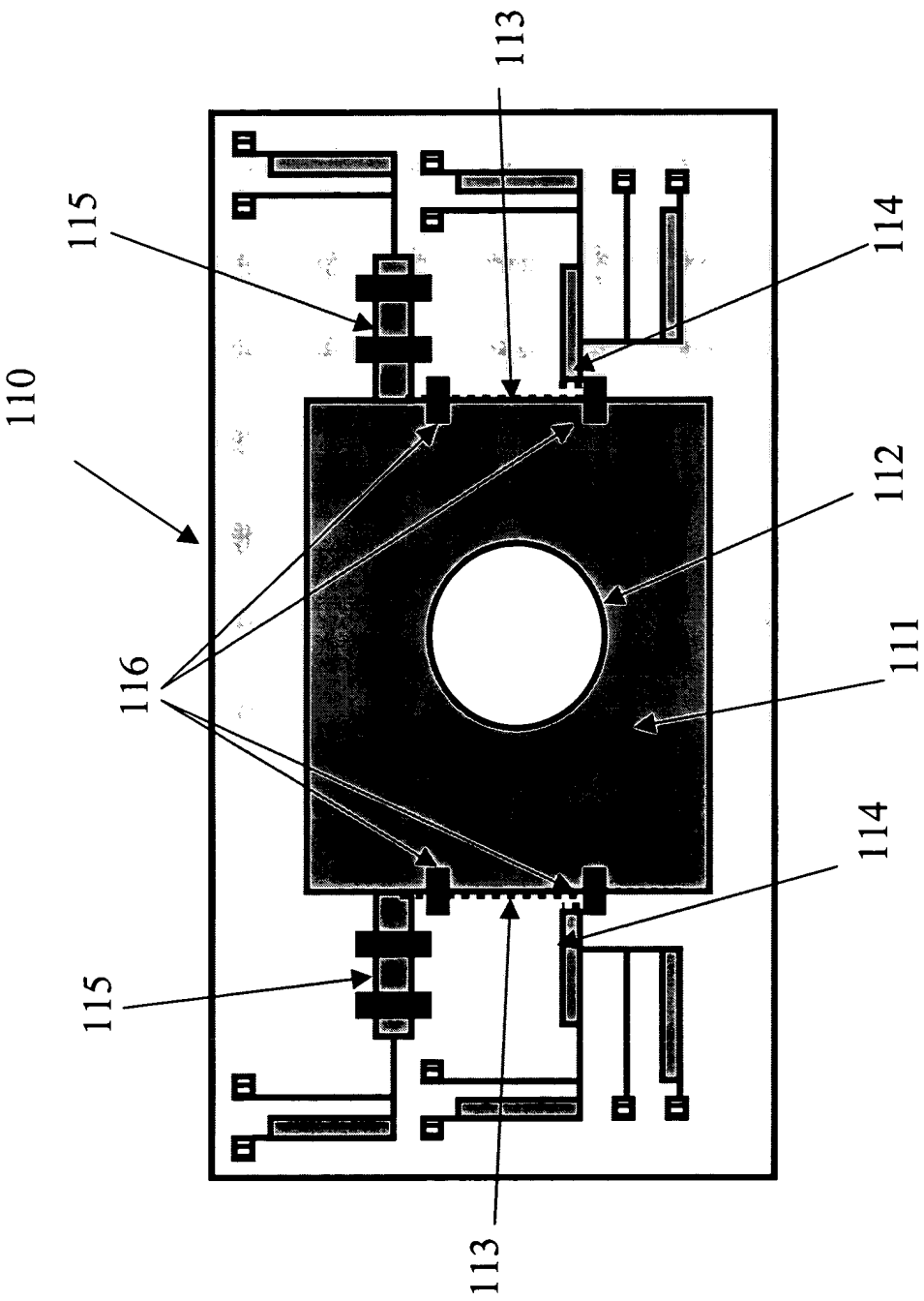


Figure 11



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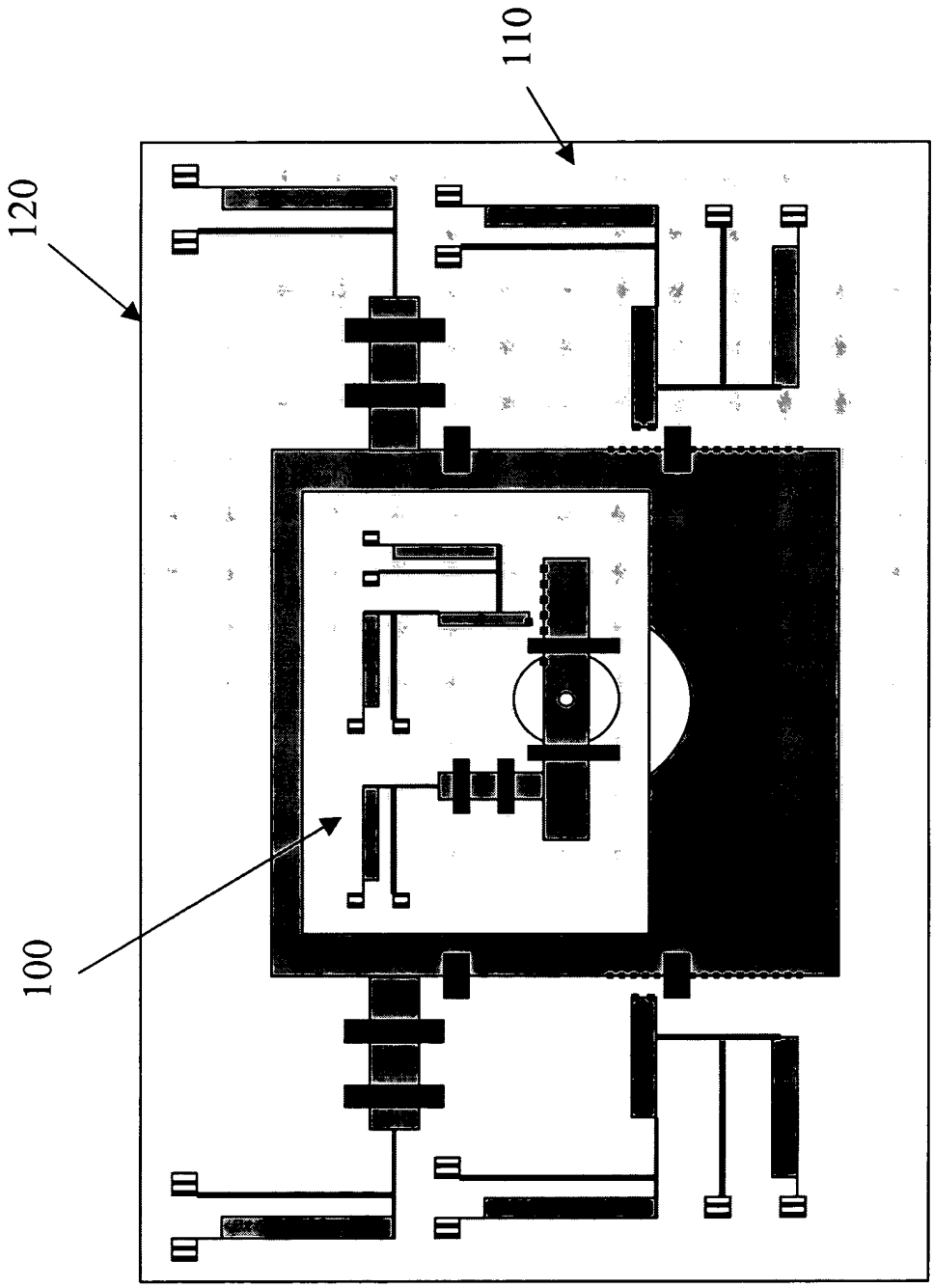


Figure 13

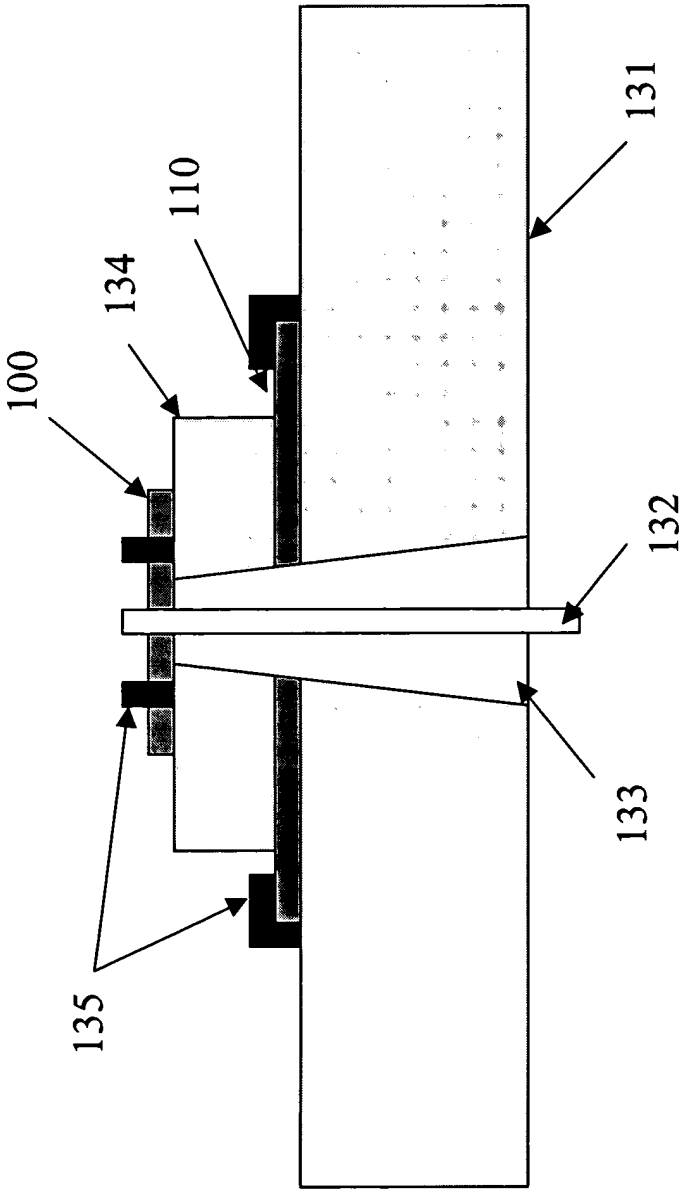
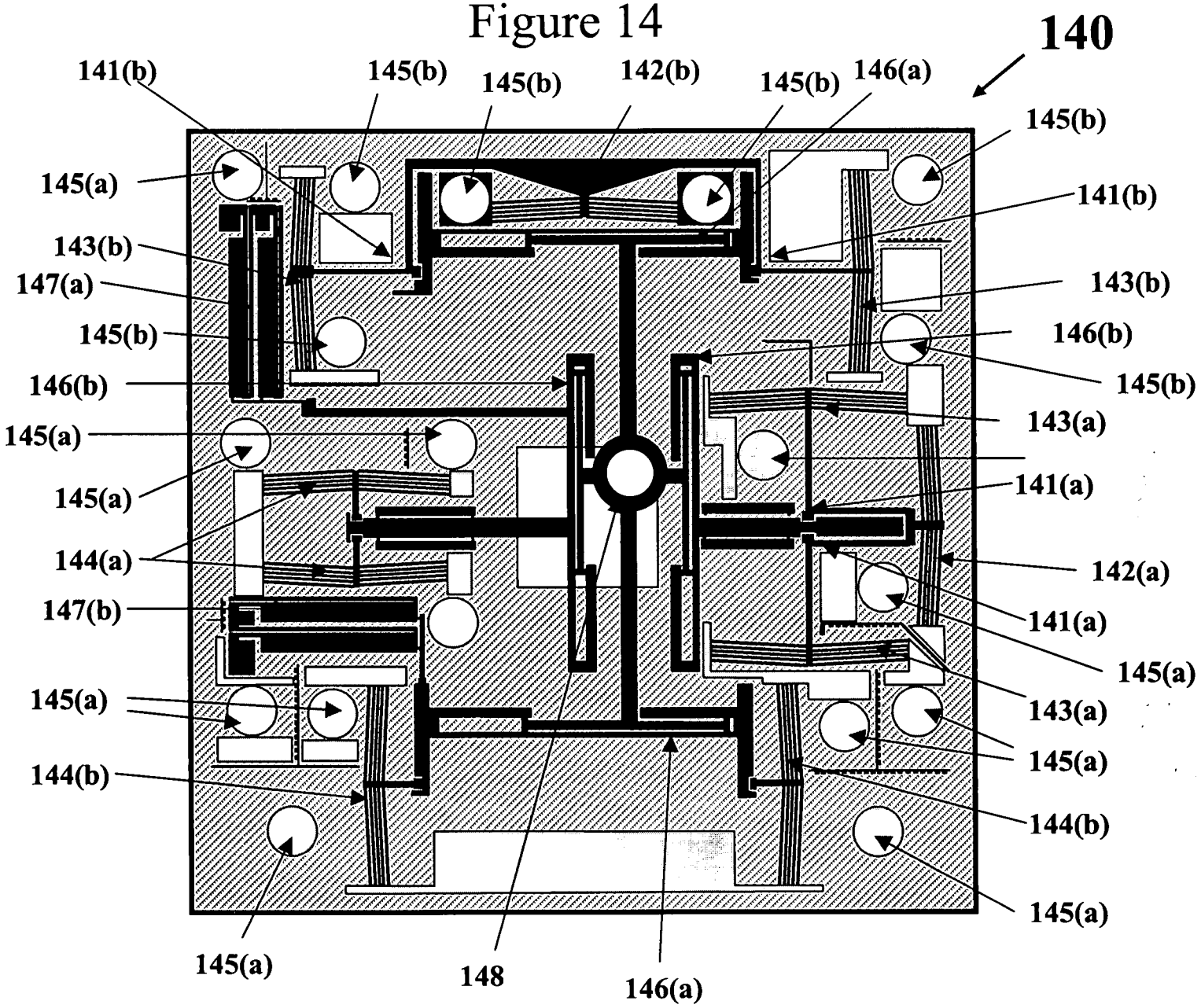


Figure 14


140
141(b)
145(b)
145(b)
142(b)
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145(a)
148
146(a)

Figure 15

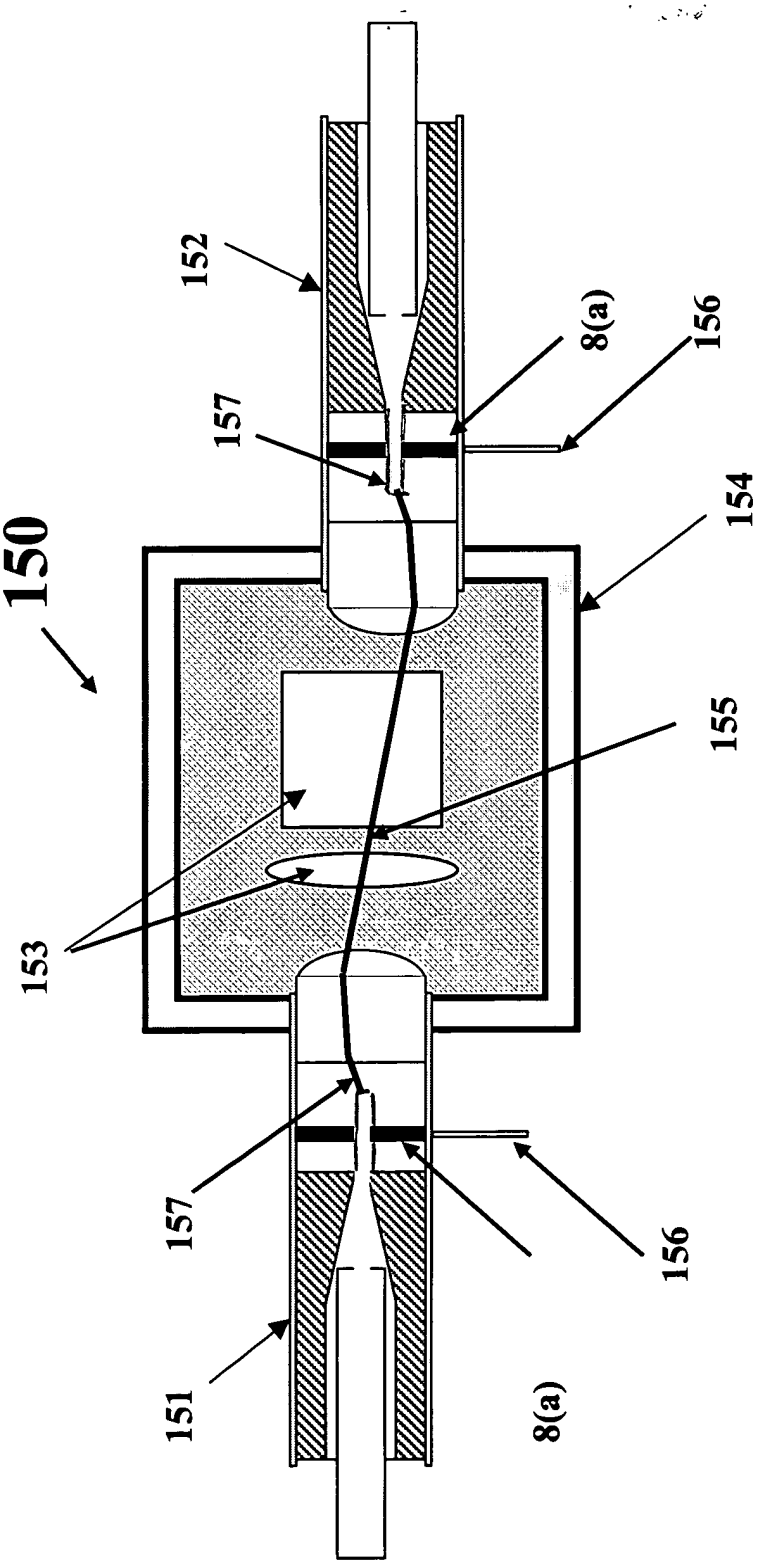
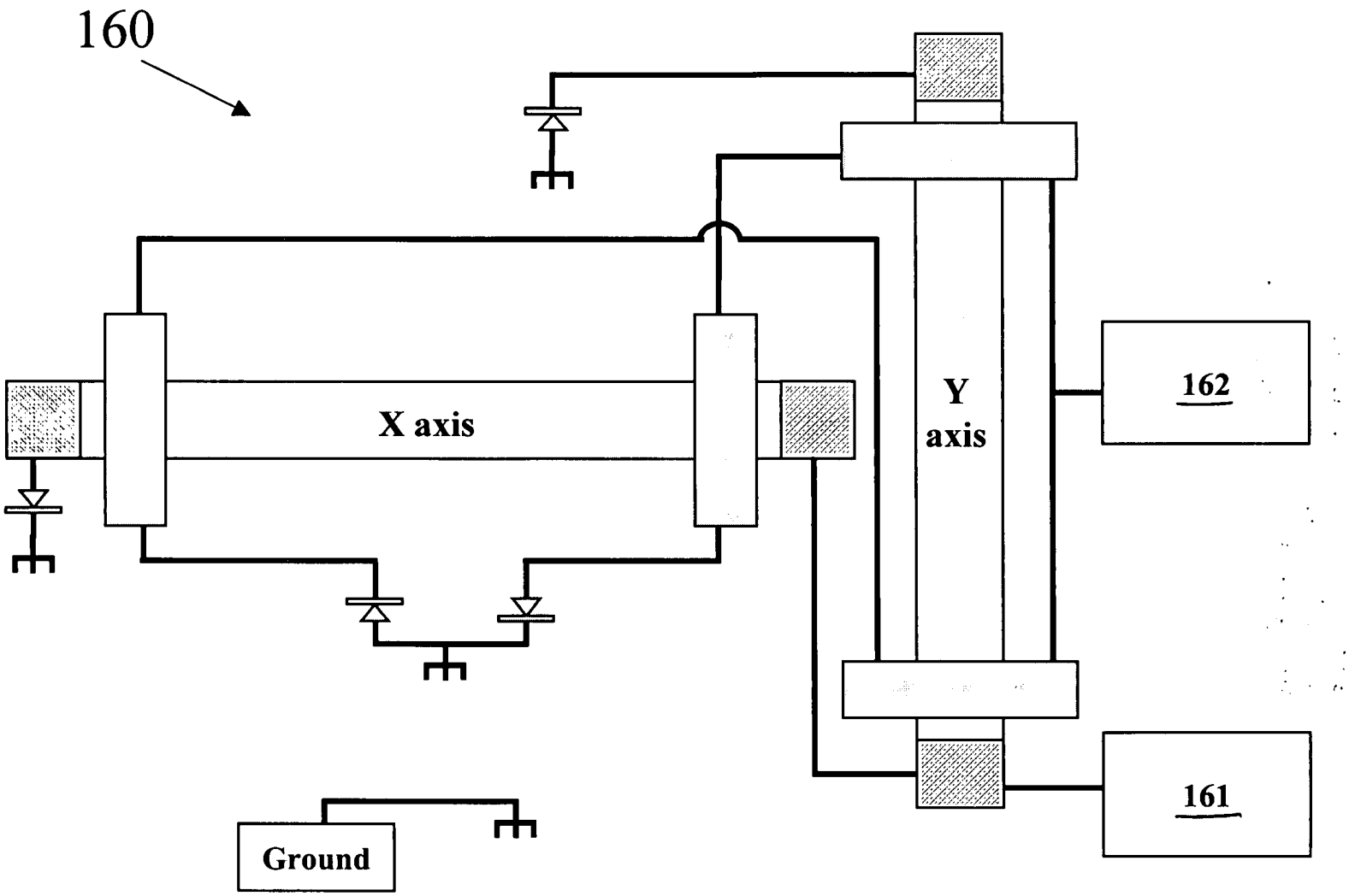


Figure 16



Logic Diagram

DIRECTION SELECTION	
Right or Up	Positive Voltage
Left or Down	Negative Voltage

AXIS SELECTION	
X	Positive Voltage
Y	Negative Voltage

Figure 17

Performance Calculations

Figure 18

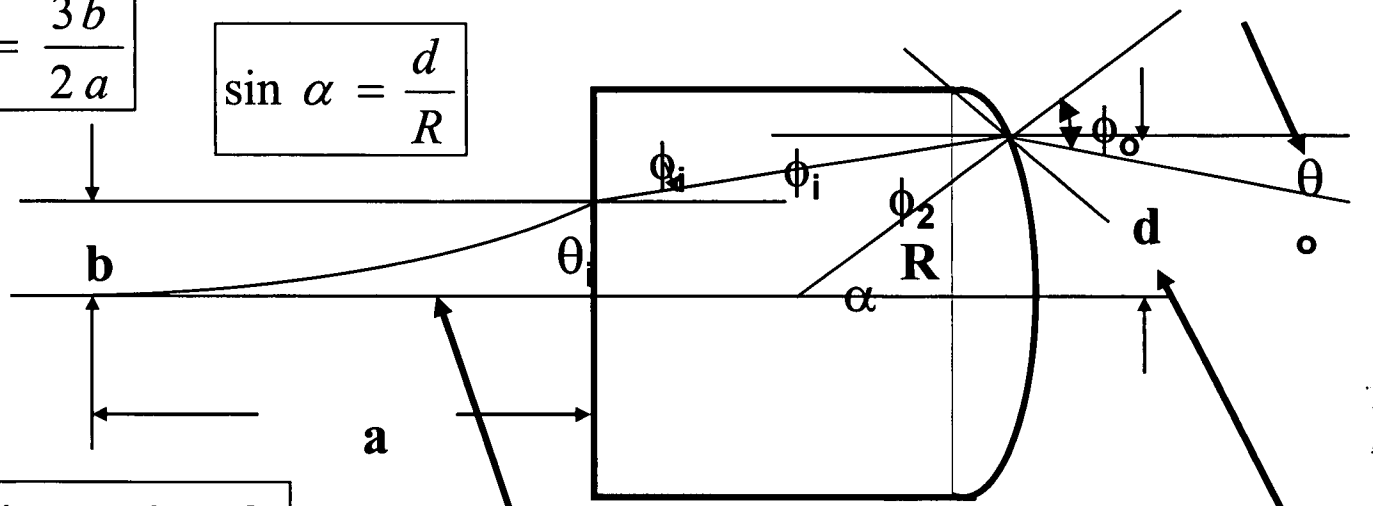
$$\phi_2 = \alpha - \phi_i$$

$$n \sin\phi_2 = \sin\phi_o$$

$$\theta_o = \phi_o - \alpha$$

$$\tan\ \theta_i = \frac{3b}{2a}$$

$$\sin\ \alpha = \frac{d}{R}$$



$$n \sin\ \phi_i = \sin\ \theta_i$$

For small displacements and uniform density,

$$y = \frac{b}{2}\left[3\left(\frac{x}{a}\right)^2 - \left(\frac{x}{a}\right)^3\right]$$

$$d = t\tan(\phi_i) + b$$

$$W = \frac{3\ IEb}{a^3}$$

Max Fiber Force

Figure 19

1 → $$W = \frac{3\,IEb}{a^3}$$

2 → $$I = \frac{\pi}{4} r^4$$

3 → $$W = \frac{3\pi}{4} E \frac{r^4}{a^3} b$$

4

FUSED SILICA

b max = 300 um Fiber Displacement

E = 102x10^5 PSI = 7.17g/um^2

a = 5000 um Fiber Length

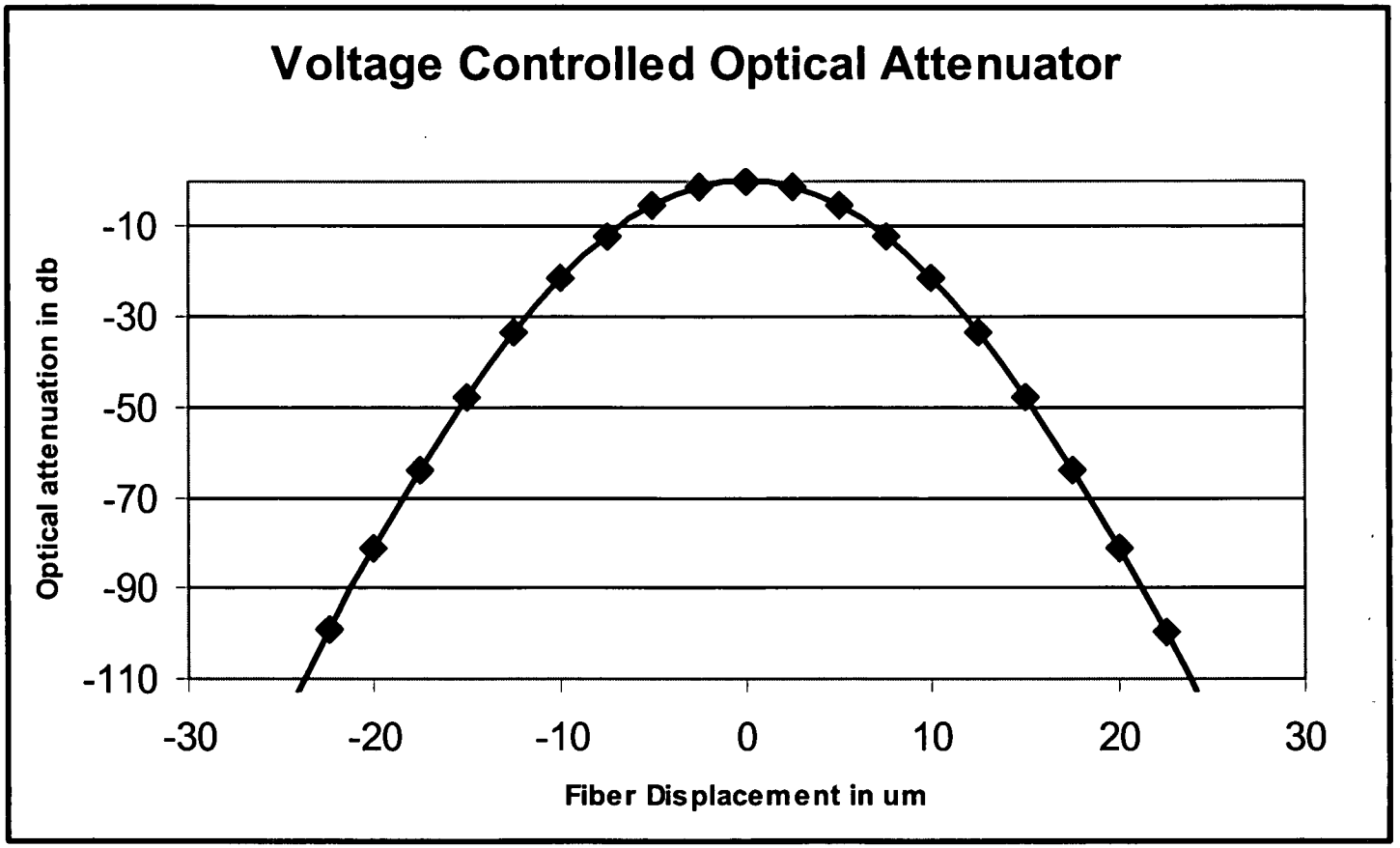
r = 62.5 um Fiber Radius

W = 2.06mg/um = 20.2uNt/um

For displacement of 100 um,
W = 2.02 mNt

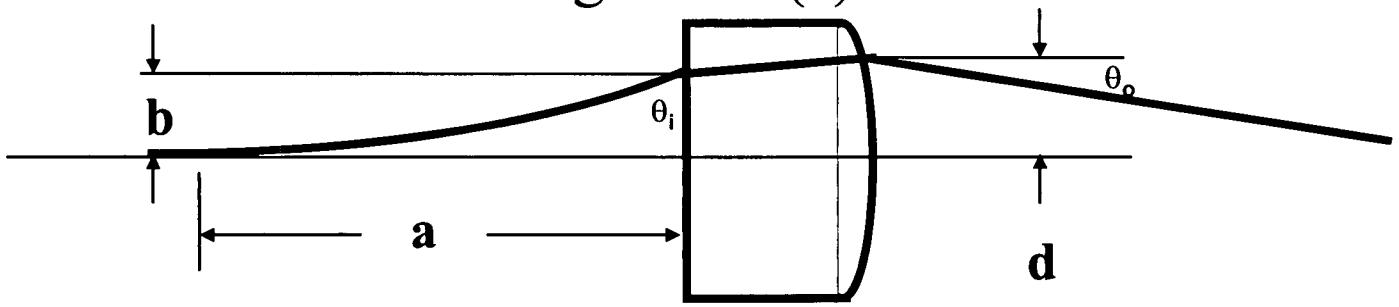
Range of Control

Figure 20



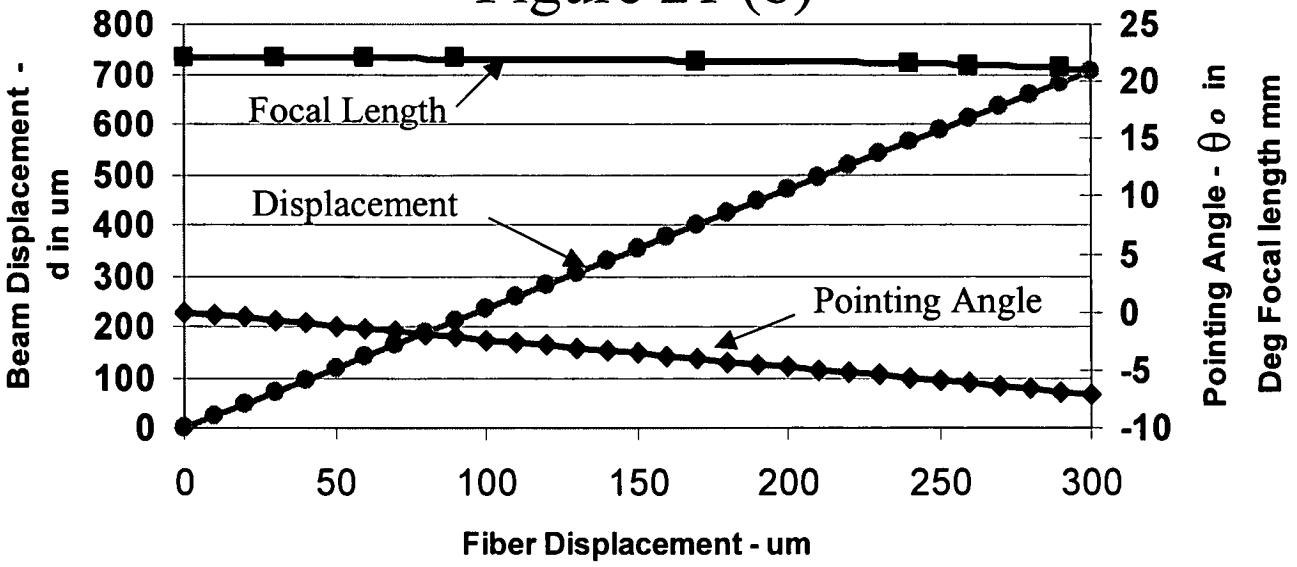
Optical Control

Figure 21 (a)



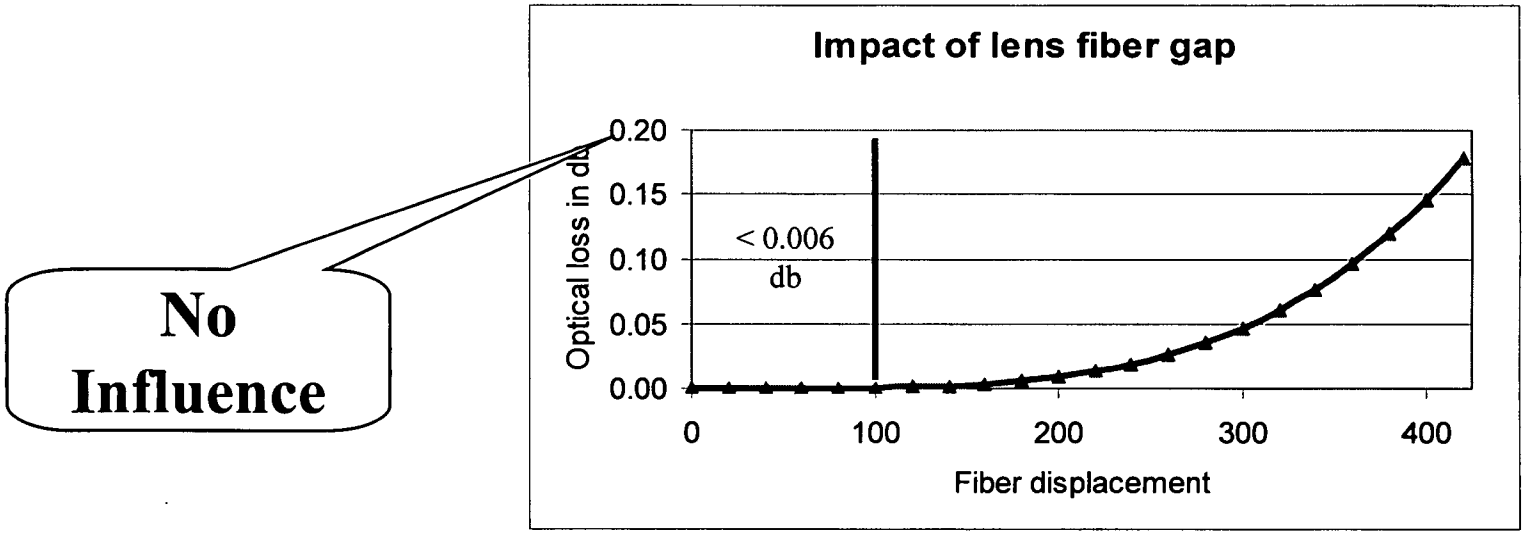
Collimator Performance

Figure 21 (b)



Constraints

Figure 22 (a)



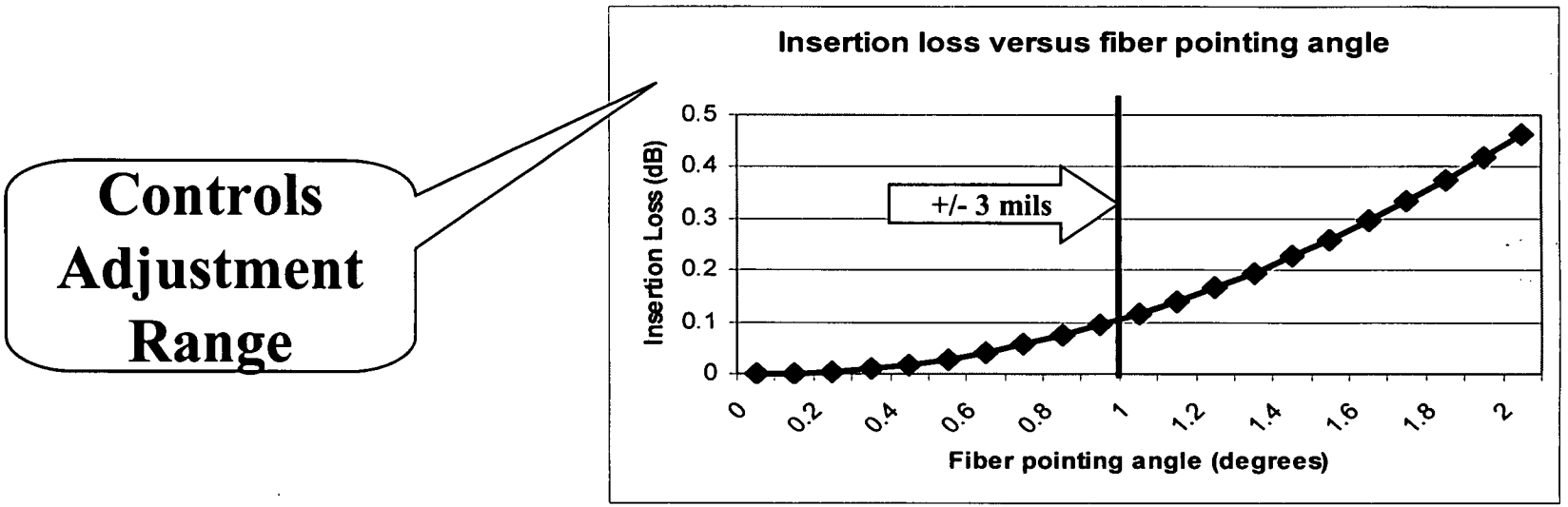


Figure 22 (b)